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OTS: 60-11,574

JPRS: 2598

20 May 1960

RESULTS OF THE FIRST ALL-CHINESE CONFERENCE ON GEOLOGY AND USEFUL MINERALS

- USSR -

by Hsu Chieh

Distributed by:

OFFICE OF TECHNICAL SERVICES
U. S. DEPARTMENT OF COMMERCE
WASHINGTON 25, D. C.
Price: $0.75

U. S. JOINT PUBLICATIONS RESEARCH SERVICE
205 EAST 42nd STREET, SUITE 300
NEW YORK 17, N. Y.

JPRS: 2598

CSO: 3601-N

RESULTS OF THE FIRST ALL-CHINESE CONFERENCE ON GEOLOGY AND USEFUL MINERALS

/This is a translation of an article written by Hsu Chieh in Sovetskaya Geologiya (Soviet Geology), No 9, Moscow, 1959, pages 3-19./

The first all-Chinese conference on geology and useful minerals opened on 10 September 1958, and lasted 11 days.

Participating in this conference were scientists and specialists from 24 provincial geological departments and autonomous regions accompanied by their field parties from the Ministry of Geology, representatives of the Ministry of Metallurgical Indistry, the Ministry of Chemical Industry, the Academy of Sciences of China and 20 other industrial and scientific research organizations in addition to representatives of 24 geological institutes and technical schools. Also participating in the conference were employees of the industrial and transportation department of the Central Committee of the Communist Party of China, the State Planning, Economic and Technical Committees, and other leading organizations of the central government.

A total of 734 persons attended the conference.

189 reports were heard at the conference including 46 on ferrous metals, 48 on nonferrous metals, 45 on rare and trace elements, 40 on nonmetallic useful minerals and 10 summary reports.

A delegation from the Soviet Union, headed by P. Ya. Antropov of the Ministry of Geology and Mineral Conservation, took part in the conference. During the conference very interesting and substantial reports were given by members of the Soviet delegation. During the study and discussion of questions concerned with prospecting for useful minerals in China many valuable recommendations were made by Soviet specialists. This was again a profound indication of the very real friendship existing between the people of China and the USSR. The conference noted the rapid development and

remarkable achievements in geological work which have been attained during the short period since the liberation of the country, owing to the sound direction by the Party, an increase in socialist consciousness and the active work of all the geologists.

After the liberation of the country geologists of the People's Republic of China located large reserves of useful minerals which were placed at the disposal of socialism and made great achievements in the field of geology. We are certain that the Chinese geologists will achieve even more in the future under the direction of the party.

Many sister socialist countries gave us either directly or indirectly a great deal of assistance in the development of geological work. In particular the Soviet Union gave much altruistic aid. Since 1952 the Soviet government has sent distinguished geological specialists to aid our country. These specialists have already passed on to us their advanced experience and have helped to train specialists. In addition our geologists have received the newest apparatus and equipment from the Soviet Union.

We are quite certain that further close collaboration with socialist countries, especially the sincere aid of the Soviet people, will undoubtedly promote even further the development of geological work in our country.

The conference proceeded quite successfully and promoted an even greater increase in geological activities. Those attending the conference expressed a general desire to further development of prospecting activities. They carried on animated discussion and underlined the need for regulating the style of geological activity. By thorough discussion and analysis of the wealth of experience that has been accumulated during geological activity since the liberation of China we have clarified certain patterns in the metallogenesis of its territory and scientifically worked out prospecting activity for the future. Without doubt this will allow an even greater increase in the scientific level of prospecting activity in our country.

A number of reports given at the conference pertain to the tasks indicated and will help us in further work.

Scientific generalization of the patterns of deposit formation of useful minerals and the results from a study of forecasts of useful minerals indicated the high level of advanced science in the Soviet Union. The reports of the

Soviet specialists(1) are quite significant in the study of patterns of deposit formation of useful minerals in our country. Many interesting reports were given at the conference by employees of the Ministry of Geology, Ministry of Metallurgy, Academy of Sciences of China, geological institutes and technical schools, provincial geological departments and geological field parties. Among them the following should be noted: 1) "Certain considerations in the classification of explored reserves of copper, lead-zinc, iron and phosphoritic ores and the thickness of the area in these deposits," 2) "Basic principles of deposit exploration," 3) "Achievements in aeromagnetic recording attained in the study of geotechnics and metallogenetic zones," 4) "Special characteristics of the distribution and conditions for formation of various types of iron deposits and directions for locating them," 5) "Varieties of industrial lead-zinc deposits in China, and methods for locating and exploring them," 6) "Varieties of industrial copper deposits in China, their distribution patterns and directions for locating them," 7) "Manganese deposits," 8) "Varieties of industrial tungsten ore deposits and their distribution," 9) "Patterns in the concentration of scattered elements in hydrothermal sulfide deposits," 10) "On Metallogenetic specialization of granitoids of eastern China according to their petrochemical characteristics" and many others. These reports, based on the results of practice during recent years, in conjunction with estimates of local conditions for formation of deposits of various types of useful minerals have determined the further direction for exploration and the route for development of exploratory methods which will bring about favorable conditions for the unfolding of prospecting and exploratory work in our country. We will not mention here the reports given by many other geologists; they will be published in the transactions of the conference. The general position of the techniques and organization of prospecting, during accelerated progress, as stated by representatives of provincial geological departments, clearly reflects the great achievements attained by unanimous party

(1) Attending the conference were the following speakers: Academician K.I. Satpayev, Corresponding Member of the USSR Academy of Sciences Kh. M. Abdullayev, Doctors of Geological-mineralogical Sciences Ye. A. Radkevich, N.V. Petrovskaya, N.I. Ginzburg, B.M. Gimmel'farb, Senior advisor to the Ministry of Geology of the Chinese People's Republic A.B. Gabelko, and others.

and mass activity in geology. Massive prospecting for useful minerals will aid the development of geological activities. All of this indicates that the direction taken by the masses in cooperation with geologists is valid and must be kept.

Geological activities since the liberation of the country have resulted in an accumulation of plentiful material which indicates that over the territory of our country there is a wide distribution of different rock formations in regional locations, according to their tectonic structure. During the course of geological history the territory of our country underwent repeated orogenetic movements which were accompanied by magmatic phenomena, development of erosion processes and an accumulation of precipitation.

All these factors created very favorable conditions for the formation of endogenous, exogenous and metamorphic deposits of useful minerals. The conditions for the formation as well as the distribution patterns of metallic and non-metallic deposits of useful minerals in the territory of China can be presented in the following form as a result of discussions of these questions at the conference:

A. Conditions of deposit formation. The majority of well-known deposits of useful metallic minerals, especially non-ferrous metals, are distributed mainly in regions of the Pacific Ocean ore belt (the eastern part of the country) and in folded zones Tyan'-Shan, Tszinlin', Tsilyan'shan, Kun'lun' shan and other mountain systems in the western part of the country. Many lead-zinc and some copper, iron and tin deposits of the deep type are primarily accociated with magmatic activity and are located in the limits of the deep fissure zone. A large part of the mercury and greater molybdenum deposits develop along small crecices leading to deep fissures. The main ore belts are distributed in fissure systems of the second and third order, along regional crevices. Concurrently some deposits of tungsten, tin, lead, zinc, mercury and antimony tend to form anticlinal and brachi-anticlinal structures. Sinitic and Devonian sedimentary iron ore and manganese deposits, large phosphorite deposits and in addition other exogenous deposits are associated with shallow deposits that have accumulated in valleys between high formations.

In dunites and serpentines large chromite deposits have already been discovered. In areas where pyroxenites, serpentinites, and other varieties of basic rocks have developed, sulfide and silicate deposits of nickel have been observed and large deposits of vanadium titanomagnetites. There are indications that tin is often associated with alaskites and

biotite granites; copper with granodiorites; iron with quartz diorites, etc. According to existing data, in certain alkaline rocks deposits of rare earth and trace elements have been observed. Magmatic specialization of minerals is a very important problem and consequently we should study it in the future in order to clarify laws from locating important types of minerals which are useful under the actual conditions in China.

The relationship between the composition of the deposit and the depth of denudation is shown by the characteristic peculiarities of exogenous deposits. So, for example, Carboniferous bauxite deposits, Sinitic and Cambrian phosphorite deposits which have been discovered in the provinces of Yun'jan' and Guychzhou are closely related to Precambrian outcrops, early Precambrian or Presinitic shells. Iron-containing deposits of sedimentary origin are also related to strata of different age (from the Sinitic to the Triassic). Other deposits however, usually do not have such a direct relationship with tectonic structures, but judging from the characteristics of iron ores, they were undoubtedly formed by changes in sedimentary conditions.

The formation of exogenous deposits is also determined by the characteristics of the paleography. For example, iron ore deposits of the Suanlun type are distributed on the periphery of a sea basin of Lower Sinitic times. Iron ore deposits of the Nansyan type are distributed in the shallow zone of the sea basin which existed during the middle and upper Devonian period. For this reason the most promising iron ore deposits of the Nansyan tyoe, for prospecting, are in the intermediate regions with a preponderance of limestone relative to the deep sea phase and the disintegrated rock formations of the continental phase. There is a clear relationship between manganese deposits and phosphorite deposit of the early gulf phase.

Deposits of the geosynclinal and platform type can be distinguished from each other by their characteristic features.

As a result of study of Chinese iron ore deposits it has been established that Presinitic sedimentary iron ore deposits of the geosynclinal type, as represented by the An'shan' type, usually have large yield and banded ore structure. In later geological periods iron ore deposits of the platform type formed predominantly, represented by the deposits of Suanlun and Nansyan'. Deposits of such ores have relatively small yield, but a high content of iron; their structure is usually oolitic. Such differences indicate the possibility of an atmospheric effect on deposit formation, the composition of the plant cover and other factors.

According to available data, a number of Chinese beauxite deposits belong to the platform type. The discovery in recent times of a large silicate-nickel deposit and bauxite deposits in the province of Futszyan' also indicates the presence of rich useful minerals in the erosion crust and on platforms.

The statements made above about the geological conditions of ore formation, even though preliminary, still allow one to draw certain conclusions about the laws of concentration of useful mineral deposits; this is of great importance for systematic organization of useful mineral exploration.

B. Conjections about metallogenic epochs and certain main types of deposits and their strata position are presented in the table below. It should be noted that, according to preliminary data, the large molybdenum deposits belong primarily to the Yenshan' period. This indicates that besides the universally recognized albian period the Yenshan' period was also a very productive one with respect to formation of useful minerals.

C. Types of deposits. As a result of large-scale geo-exploratory work carried out after the liberation of China we not only discovered rich deposits of useful minerals but introduced certain contributions to the theory of metallogenesis based on a large number of new facts.

The largest deposits of a new type, first discovered and characterized in our country, are briefly described below.

1. A hypothermal and pneumatolytic-metasomatic deposit of magnetite and hematite with rare earth elements found in Presinitic dolomites and genetically related to alkaline granite. Besides hematite and magnetite the body of ore contains an irregular interspersion of fluorite and is rich in sodium amphibole and pyroxene and rare earth minerals.

2. In northwestern and northeastern China large molybdenum deposits have been observed on the vein-interspersed type; these are the world's largest reserves. They even exceed the deposits in America, considered to be the world's largest. In the northeast a monometallic skarntype deposit has also been found. At present it is clear that this deposit is of great industrial interest.

3. Tin deposits in skarns are quite promising in our country. They have forwed in the contact zone of carbonaceous

rocks with intrusions of granites, granite-porphyries, and quartz prphyries. At present it is clear that reserves of these deposits are adequately large.

Cassiterite-sulfide tin deposits are especially widely distributed. Associated with them are deluvial and eluvial placer deposits of relatively large size.

4. In the well-known tungsten region, located in the southern part of our country, two types of deposits are found primarily: wolframite-quartz and gangue-Scheelite. Wolframite-quartzes occur in alumo-silicate rocks and Scheelite deposits of the skarn type mainly occur in carbonaceous rocks. Both of these types of deposits are quite promising.

5. Antimony deposits in the province of Khunan' and eluvial antimony oxide deposits in the province of Guan'si are specific types of deposits which are characteristic to our country.

The antimony deposit in the province of Khunan belongs to the Devonian silicified limestones. The ore beds of the deposit are overlapped by schists. The ore is found in pockets, veins and in the form of impregnations. The size of these deposits is quite large. Antimony deposits of the Yutszyan type are found in the red stratum of the third era.

6. A very large deposit of piezcquartz has been observed with oxidized skarns; it is a new type of deposit in our country.

7. There are different types of asbestos deposits. Among them are deposits of longitudinal fibrous chrysotile asbestos in the Miman district of Sychuan' province: the maximum fiber length of the asbestos here sometimes exceeds 2 meters. This deposit in size and quality of fiber is one of the greatest in the world.

8. Deposits of phosphorites of sedimentary origin belong primarily to the Sinitic and Cambrian periods. The deposits of phosphorites have a sheetlike form. These deposits are large and relatively rare in the world. The Kayyan' phosphorite deposit in Guychzhou province is a typical example of a sedimentary phosphorite deposit of the Sinitic period.

Sedimentary phosphorite deposits of the Cambrian era are found in Yun'yan province. Besides the two types of deposits described above, metamorphized sedimentary phosphorite deposits have been observed in Tszyansa, An'kha and in other regions; up to now these types were rather rarely

met. These deposits are located in crystalline schists and carbonaceous rocks.

9. In the northwest of our country salt lakes have been found containing potassium, bromine, boron, and iodine. This discovery opened a new path for prospecting of potassium-boron deposits. In the salt lakes of this region are quantities of lazurite, gypsum and other more valuable types of mineral resources.

Contact-metasomatic rare metal deposits of rather large size have been observed in the northeast of China. They occur in the contact zone of carbonaceous rocks with granitoids. Besides the large deposits mentioned, other deposits of high quality and large size have also been discovered; these are of great industrial significance. Among them are:

1. Striated magnetite and hematite ores occurring in Prosinitic metamorphic rocks. Their analogs in the Soviet Union are ferrous quartzites and in America jespilites. In these deposits there are also rich ores formed by hydrothermal processes. Materials from exploration and their study attest to the possibility of finding similar deposits in regions of early strata development in our country.

2. Elluvial and delluvial manganese deposits distributed in the subtropical regions of our country. They are convenient to work and are distinguished by a relatively good quality of ore. Larger manganese deposits in China are of marine origin. In addition, deposits of lake origin have been observed here - the manganese hat type deposit and also hydrothermal deposits.

3. In the northern part of the country large deposits of chromite have been discovered, associated with dunites.

4. A sheet copper deposit of the Dunchuan type associated with dolomite limestones, which is monometallic. A vein-interspersed copper deposit of substantial size is known in the north of the country, where it is associated with Prosinitic metamorphic granodiorites. Another deposit of the vein-interspersed type which is of earlier origin is located in the Ban'si strata in Tszyansi. Large copper deposits of the pyritic type have been uncovered in the northwestern regions. They are associated with strata of spilites, keratophyres and analagous foreign deposits of this type. In addition there are well-known copper deposits in skarns which are of great industrial importance.

5. Lead-zinc deposits of the skarn type which are of great economic importance. They have been discovered in the southern provinces and in northeastern China. These deposits are associated with limestones and are of hypo- and mesothermal contact-metasomatic origin, being combined with small intrusions of average oxide composition and characterized by an ore of complex mineralogical composition.

Lead-zinc deposits of the vein type, observed in the provinces of Khunan', Tsinkhay and in other regions, belong to deposits of the mesothermal type and are associated with tectonic fissures in different rocks. The material composition of the ores is not very complex. Reserves are rather large.

6. Deposits of magnesite, discovered in the northeast of the country, are associated with strata of Presinitic dolomites and limestones. Productive deposits here have sheetlike form and are characterized by large reserves.

7. Large hydrothermal-metasomatic deposits of alunite have been discovered in eastern China. They are associated with tuff and tuffaceous breccia and are of sheetlike and lenticular form. Gallium is contained in the ores of these deposits.

8. Deposits of mercury, associated with rocks of different age (from Cambrian to Triassic inclusive) have developed in the southwestern part of the country. In the majority of cases mercuric mineralization here tends to be near large fractures.

9. Our country is rich in resources of rare and trace elements. Prospecting for rare elements began recently, but has already given good results. So, for example, an iron ore deposit has been discovered which contains rare earth elements; this deposit belongs to a completely new type which up to now has never been found anywhere. In the northwestern part of the country an important niobium-tantalum deposit has been found. It has been shown that many lead-zinc polymetallic deposits are characterized by a high content of gallium, cadmium and other rare elements.

Many large deposits have been discovered which are of various genetic types and are distinguished by ores of high quality; this attests to the fact that our country is rich in useful minerals. This refutes the conviction of geologists of the capitalist countries that the mineral resources of China are poor. We are quite sure that with the development

of geological investigations many new deposits of useful minerals will be discovered that will satisfy all the growing needs of the socialist construction of China under an accelerated pace.

D. Metallogenic provinces. In China there is still insufficient work being done to find metallogenic provinces. According to the peculiarities of useful mineral distribution all the territory of our country may be divided into two large metallogenic regions - east and west.

The east metallogenic region, beginning with the Great Khingan Range, stretches through the provinces of Khebey, Shan'si, including the islands of Khaynan' and Tayvan'. This metallogenic region belongs to the outer zone of the Pacific Ocean ore belt (except for Tayvan which belongs to the inner zone of this belt). The geological structure of the region described is somewhat different in the south than in the north. In general it is characterized by rather intensive Cenozoic and Mesozoic magmatic activity. Manifestations of Varissk and Precambrian magmatism can be noted also.

The group of useful minerals of this metallogenic region, which is typical for the outer zone of the Pacific Ocean ore belt, is characterized by the presence of large copper and iron ore deposits.

The following metallogenic provinces can be distinguished from the north to the south in this metallogenic region:

1. The northern metallogenetic province of northeastern China includes the plicated zone of the Great Khingan, the Sunlyao plain and its eastern areas. It is characterized by Yenshan' magmatic activity. A series of important ore deposits were formed chiefly at that time. There are facts testifying to the presence of Caledonian and Precambrian ore deposits, which have still not been thoroughly exploited. Recently signs of copper deposits were discovered in porphyry in the Great Khingan. Scheelite, tungsten and Cassiterite are often found in the Schlich. We know of deeply metamorphosed iron ore deposits of medium and small size, which also deserve attention. In the alkaline liparites of this area, rare and trace elements were discovered. More attention should also be paid to prospecting for rare and trace elements in alkaline rocks, deposited in the Fun'chzhen and Tszokheykou areas.

2. The Lyaonin-Girin inner Mongolia metallogenetic province includes the Lyaonin-Mongolian geosyncline, the Lyaodun shield, and the Yanshan'-Lyaonin parageosyncline.

Within the bounds of the Lyaonin-Mongolians geosynclines deposits of copper-nickel, chromite and silicate nickel formed in Varissk times were discovered. Furthermore the chromite deposits enjoy the widest distribution. We know of molybdenum deposits of great value in this area, presumably from the Yenshan' age. Apart from this magnesite deposits were discovered here.

The province in question also includes the area of inner Mongolia, remarkable for its wide distribution of ultra-basic rocks. This region is interesting for chromite prospecting.

Within the bounds of the Lyaodun-Mongolian shield, among precambrian metamorphic layers, there are known to be deposits of magnesite, iron deposits of the An'shan' type, hypothermal and pneumatolithic-metasomatic haematite and magnetite deposits, containing rare elements linked with pegmatite veins.

In the Yanshan'-Lyaonin parageosyncline vanadium-titanium-magnetite and copper-nickel deposits were discovered, copper deposits of the Skarn type and hydrothermal deposits of non-ferrous metals, and also chromite deposits. In the southern district of the shield quartz-wolframite veins were discovered.

The territory in question appears to be a complex and very important metallogenetic province. It is characterized by a wide distribution of rare and trace elements. Finds of scheelite deposits are possible.

3. The metallogenetic province of northern China includes the Shansi and Khoybey plateaus, the north China plain, the Shandun' mountain range, the Khueyyan shield and part of the Tsinlin mountain range. In the Shandun' mountain range important copper deposits and deposits of iron of precambrian age were found.

In the Shandun' mountain range and the Tsinlin mountain range iron deposits of the Skarn type were formed during the Yenshan' epoch.

On the Klueyyan shield and on its periphery metamorphosed sedimentary deposits of phosphorites of Precambrian age are distributed. Deposits of precious metals were also established to be here. This area seems to be promising also for further prospecting for iron ore deposits of the An'shan type, for copper deposits of the Chzhuntyaoshan' type and for other deposits of ferrous and non ferrous metal of the Yenshan age.

Shansi is a district famous for alkaline rock development. For this reason it is necessary to turn our attention

toward prospecting for deposits of rare and trace elements. We mus t also give our attention to the alkaline trachytes, covering the Shan'dun province in the eastern parts.

4. The metallogenetic province of southeastern China includes Tszyanan and contiguous areas. In this province the mesocenozoic magmatic activity appears to have been the most intensive. The major metallogenetic epoch is related to the Yenshan period, but there are probably also signs of somewhat earlier metallogenetic epochs here. In the Tszyansi, Khunan' and Guychzhou areas granites are widely spread. Deposits of W, Sn, Sb, Pb, Zn, rare and trace elements were discovered here. Important deposits of iron and copper originated in the flexure zones of Yantszyan and Chzhotszyan-Guangi located in the south and north of Tszyanan. On the Khaynan island and in the coastal areas of the Futszyan' and Guandun provinces, there are known to be deposits of iron of the Skarn type, of real value.

Gold, antimony, scheelite and numerous lead-zinc deposits, discovered in Tszyannan, can be referred to earlier metallogenetic epochs than the Yenshan'.

This province is characterized by the Pacific Ocean ore belt and holds must promise for prospecting for deposits of different metals.

In the Tszyansi and Khunan provinces in Tszyannan large iron ore deposits of the sedimentary-metamorphic type were found, similar to the iron ore deposits of An'shan, which present wide perspectives for prospecting for iron ore in the area of the development of Prosinitic layers further south than the Yantszy river. The upper Devonian iron ore deposits also deserve attention, as do the different manganese and gypsum deposits of a different age, forming at the expense of tertiary basalt in the Primor area.

5. The metallogenetic province of Tayuan' island belongs to the inner zone of the Pacific Ocean metallogenetic belt and is characterized by the wide distribution of copper deposits of the Tszinguashin type.

The western metallogenetic region includes the northwestern and southwestern areas of China. The signs of ore deposits are here connected with the plicated zones of Tyan'-Shan', Chilyan, Kun'lun, Altai and the Himalayas which border the Tsaydam, Tarium, Dzhungar and Sychuan' depressions. The ore deposits are of Uarissic and Caledonian age. The Kun'lun and Tibet areas present a special case, for they witnessed middle Cenozoic magmatic activity. The region in question can be divided into five metallogenetic provinces:

1. The northwestern metallogenetic province includes the Altaic, Tyan'shan, Chilyan'shan, Kun'lun' and Tsinlin' plicated zones and the Dzhungar, Tarim and Tsaydam depressions. Here within the bounds of Altay granites with pegmatites have formed, with which deposits of rare elements are also connected; the Chilyan'shan plicated zone is thought to be responsible for the deposits of gold of Presinitic age, and also for the metamorphosed deposits of native copper of Khuanlun; within the plicated zone of Tsinlin there are known to be copper deposits of the pyritic type, lead-zinc, chromite, platinum and copper-nickel deposits and also manganese deposits, connected with volcanic rocks. Their age is mainly Caledonian or early Varissk. In this area a large iron ore deposit has also been discovered, the age of which has not been determined precisely.

Within the bounds of the plicated zones of the Tyan'-Shan' system, ore formations of copper, lead, zinc and iron are of great importance. These deposits originated mainly in the Varissk time, nevertheless, it is possible that a part of them are of Caleconian age. The age of the tungsten and molybdenum ore deposits in the northern parts of Tyan'-Shan' has still not been established. In the region of Kukunor Lake, copper and polymetallic deposits of the Skarn type have been discovered. They are from the Mesozoic era.

In the Tsaydam, Tarim and Dzhungar depressions, there are saline lakes which are a source for the extraction of potash and common salt, mirabilite and borax.

2. The metallogenetic province Sychuan'-Khunan'-Guychzhou-Guansi includes the Sychuan' depression, the Sychuan'-Khunan' flexures and the Guychzhou-Khunan-Gansi plateaus. Magmatic activity is not characteristic in this province. Of the deposits of useful minerals discovered here, we should note the copper, lead and zinc deposits, originating in the Sinitic and lower Paleozoic eras. Less important are the phosphorite deposits of the Sinitic and cambrian periods, and also manganese deposits located in carboniferous, permian, Devonian and Sinitic strata.

Mercurial ore deposits are widely distributed in the province in question and also call for attention, nevertheless their genesis and time of formation are not yet clarified.

The above mentioned province seems to hold promise for the prospecting for industrial deposits of phosphorites. Within the bounds of the Guychzhou-Guansi plateau attention should be paid to prospecting for lead-zinc deposits.

Recently deposits of copper sandstone of industrial interest have been discovered in the Sychuan depression, and

and tungsten ore deposits have been found in the Guychzhou province.

3. The Kamyun'nan' metallogenetic province unites the district of the Kamyun'nan axis and the district basalt development on both its sides. The metallogenetic epoch chiefly coincides with the Varissk age. In the deeply eroded district of the Kamyun'nan axis the intrusive phase of Permian differentiated basalt is most developed. Of the deposits discovered here, we should mention the Dunchuan copper deposit, the Panchzhikhua vanadium-titanium-magnetite deposit, the Imyn' iron ore deposit, the Limakho copper-nickel deposit and the nickel deposits in the middle part of Yun'nan. On the sides of the Kamyun'nan axis are distributed lead-nickel deposits and deposits of native copper in basalt. The copper deposits of modotsa and also the copper deposits in the red strata are considered to be Dermian, Triassic and Cretaceous period deposits. On the periphery of the Kamyun'nan axis, phosphorite deposits of sedimentary origin, characteristic of this province, are widely distributed.

4. The metallogenetic province of the mountain system of Khen-Duan'shan' includes the western areas of Sychuan' and Yun'nan provinces. A highly intensive Yenshan' magmatic activity is noticeable here, as a result of which lead-zinc, mercury, antimony and arsenic deposits have formed in the western part of the Yun'nan province. All these deposits seem very promising. The prospects of the lead-zinc deposits are to a great extent determined by their position near the large lead-zinc deposit Loin'gan in Burma.

Taking into account the territorial proximity of the province in question to the tin-metallogenetic belts, running along the coast of the South China Sea, we can envisage the possibility of discovering tin and tungsten deposits, interesting in the practical sense.

5. The Tibetan metallogenetic province includes the Kun'lun', Tangulashan', and Himalaya plicated zones. On the basis of the geological conditions, it can be supposed that in the northern parts of the province in question, the Varissk and Yenshan' metallogenetic epochs played a leading role in the ore formation, and in the southern part, the Himalayan. According to the available information, in the Tibet lake area, there are side by side deposits of halite and mirabilite and boric deposits. There are a fair number of iron ore and non ferrous metal deposits in the province in question but they have not yet been evaluated. In this area there are widely

distributed ultrabasic deposits, including cobalt-nickel ore formations, which deserve attention. Numerous other ore deposits will most probably be discovered in Tibet.

Exploration work in the field of prospecting for deposits is at present in the initial stage in our country, that is why such problems as the magmatic specialization of ore formation, the control of the rocks contained, the genesis and metallogenetic epochs of some deposits are still not solved, and need further consideration. The facts already available on these questions should not be treated dogmatically. Following the liberation of China, thanks to the great development of geological activity, we obtained valuable scientific material. We have good ground to assume that in connection with the great leap forward in geological activities we will obtain even more valuable scientific material, which will raise the level of geological research and help us to achieve new successes in our industrial activity.

III. At the present time our country has begun to fulfill the second five year plan. As a result of the move to regulate the methods of work and of the propagation of the general party line throughout the country, an amazing rise in production is noticeable - leap after leap in all industrial and agricultural districts. "Now one day equals 20 years". Such a rapid development requires us to discover still more kinds of mineral raw material as quickly as possible.

The concrete needs in the second five year plan with regard to prospecting and exploration activity consist of a rapid, inclusive search for various kinds of mineral raw material and simultaneously in accordance with the development of metallurgy the preparation of sufficient stocks on non ferrous metals, rare and trace elements, non metals, fuels and raw material for the needs of the chemical industry, and also of stocks of construction material.

To economize on the capital investment and to hasten the mastering of large scale, medium and small scale deposits, attention must be given to prospecting for rich ores and ore bodies more easily reached for exploitation; when prospecting for different kinds of mineral raw materials, it is essential to take into consideration the possibility of creating a complete industrial system in the area in question.

The performance of these tasks demands further renunciation of blind faith and ideological liberation, which are the most important premises for the successful discovery of a still greater quantity of diverse useful minerals. It is known that some geologists have considered it foolish to look for useful minerals in certain deposits or areas. This outlook

hindered the development of prospecting. Many reports were read during this conference which said that we have already succeeded in discovering a whole series of useful minerals in just those deposits and areas which were considered uninteresting. This is a vivid example of how necessary it is to break with outdated traditions and renounce blind faith. For example, deposits of phosphorites may be found in the northern regions of China, just as accumulations of the latter may be expected in the depths of a transgressive formation of any size. It was formerly thought that successful prospecting for deposits of rare and trace elements was possible only in regions of igneous rock development; it has however, now been established that these useful minerals occur both in sedimentary and metamorphic rocks. Views exist that people not specializing in geology cannot cope with prospecting for deposits of useful minerals, nevertheless, because of certain facts we hold the opposite view - many deposits have been found by laymen. All these facts unquestionably bear witness to the importance of renouncing blind faith. If the geologists make the greatest effort possible and show initiative, they can discover a variety of useful minerals on our territories.

We must put into further practice the policy of "simultaneous development of industry, centralization and local industry simultaneous development of large scale, medium and small scale enterprise". While prospecting for large deposits, we must simultaneously intensify prospecting for medium and small deposits, this being of the utmost importance in order to satisfy completely the demand of local, medium and small enterprises for mineral raw material. Steps must be taken to assure a 10.7 million ton steel output by the end of 1958.

In the future, prospecting knowledge must be spread in a timely and systematic way, in particular the knowledge of prospecting for medium and small deposits, so as to satisfy in good time the needs of the widely developing medium and small enterprises.

We must further realize the policy of the masses participating in geological work. Successes achieved in 1958 prove that important measures have been taken in the field of geological prospecting - mystical views toward geological work have been destroyed and the policy of mass participation has been put into practice. This will promote the quick discovery of resources of mineral raw material of every kind to be found in the soil of our country. It will be essential in the future to mobilize the masses and to rely upon them when prospecting for deposits, not only on the surface but also underground. Apart from this, the masses must be mobilized

to prospect for and evaluate deposits of useful minerals.

At the present time geological organizations have already been formed in all provinces, autonomous districts and towns. In the district and country, the policy of engaging the whole party and the whole nation in geological work is being realized in every possible way under the direction of party committees and observing the principles of all round planning and of a unified organization of work. To realize this policy even further the following must be achieved:

1. Geological knowledge, the technique and methods of prospecting must be spread in every way possible; short term courses to familiarize people with geology, the technique of chemical analysis and other tasks must be organized; popular geological literature and brochures of basic knowledge of prospecting for useful minerals must be published in greater volume. It is essential that all this be done in order to achieve a general rise in the level of geological knowledge in the masses, and thus to achieve the even greater dissemination of this knowledge.

2. The policy of engaging the whole party and the whole nation in geological work requires the formation and strengthening of mass prospecting organizations. At the present time, thanks to the work of party committees, geological organizations have been formed in certain districts, these are organizations for prospecting and laying claims in villages. Where such organizations have been formed, their management should be reinforced, active cadres should be trained, and geological work should be directed toward organized development of mass prospecting. Where such organizations have not been formed, however, there is an urgent need for them.

3. As a result of mass participation in prospecting, a new technique has been invented and rich experience accumulated which is scientifically meaningful. Serious attention must be given to one and the other. The experience accumulated by the masses may not only enrich the theory of geological science, but may also permit better practice of the policy of "more, quicker, better, cheaper". For this reason, during future prospecting we must consistently realize the policy of "combining modern and primitive methods" in order to enhance the effectiveness of geological prospecting.

Prospecting methods must be perfected in every possible way, allowing economy in capital investment for prospecting and increasing the effectiveness of prospecting. While observing the needs of projected organizations it will allow us to

lower accordingly the correlation of high grade reserves, by decreasing the density of the prospecting network. The realization of these important measures will promote the putting into practice of the policy of "more, quicker, better, cheaper". In our country as in others, the practice of studying mineral resources affirms the importance of this question. Last year a great deal of material dealing with this question was gathered and studied, and the interested local organizations were consulted. At the present conference many comrades made valuable comments.

On the basis of the discussion of this material, we choose the following principal suggestions for the perfection of geological prospecting:

1. The knowledge of an accelerated method of prospecting should be spread and prospecting work carried out rationally, with the aim of increasing its effectiveness.

2. The correlation of large deposits of first grade reserves should be decreased accordingly.

3. For medium size deposits chiefly second grade reserves should be revealed.

4. Prospective strips of complex deposits should be outlined, and after partial evaluation of the lower grade reserves, prospecting should be continued and extraction begun.

5. The exploration os small deposits should be realized by means of surface examination and after the contents and reserves have been established, exploitation should begin.

In accordance with these principles the Chinese People's Republic Ministry of Geology and interested organizations worked out instructions for the calculation of reserves and the technique of geological prospecting. In the future, instructions must not be adapted mechanically, but after the evaluation of concrete facts. In further practice, as new experience is accumulated, these instructions will have to be correspondingly revised and improved, so as to increase the effectiveness of geological operations.

More expedient and economical complex utilization of diverse mineral resources is essential. In a number of cases, complex utilization of mineral resources not only permits the raising of the economic value of useful minerals,

but also promotes the discovery of supplementary sources of certain useful minerals quite essential to the country, in particular rare and trace elements, which it now needs. During future prospecting, special attention should be directed towards complex utilization of useful minerals. The law of paragenesis of rare and trace elements with the usual minerals, makes it essential to examine systematically and according to plan the initial ores, concentrates and metallic products, tailings, slag, pitch, ashes and escaping gas for rare and trace elements with the aim of extracting them.

In the near future, in conjunction with prospecting operations, it will be essential to make a regional geological survey as quickly as possible, and to draw up a more precise and detailed geological map of China's territories. Within one to two years, geological maps based on concrete terms should be drawn up for each province and autonomous district, to a scale of 1:200,000 for areas where there is a prospect of discovering useful minerals and for areas with an important meaning for national economy, and to a scale of 1:500,000 or 1:1000,000 for other areas. On the basis of geological maps, metallogenic maps and forecasting maps should be drawn up to a scale of 1:1,000,000, so as to ensure the possibility of publishing an all-China summarized geological map and metallogenic map to a scale of 1:2,500,000.

Scientific research operations must be intensified. The enormous volume of geological prospecting carried out during the period following the liberation of China has enabled us to obtain much valuable information, permitting the development of our native geological science.

In order to assure the success of scientific research operations, it is essential to overcome dogmatism, subjectivism and the tendency of separating scientific research operations from industry. Industrial operations must be combined with research work and research work must serve industry. Industrial and research organizations should direct their activities towards raising the quality of their work, while using complex methods. Scientific research organizations should be formed gradually, depending on the needs of practical operations in the separate areas and provinces. Geological departments should assist industry through their subordinate scientific research organizations.

It is essential to intensify collaboration between countries and within the country. In the past years, all sister socialist countries have collaborated with our country. The Government of the Soviet Union has sent a great number of specialists to China and has given us every

technical assistance. Recently, in connection with the announcement of the technical collaboration between the Chinese People's Republic and the USSR, many prominent specialists have been sent to us to assist us in the important scientific research operations. I am convinced that with their direct assistance we will fulfill our tasks even better. All our geologists should try to benefit seriously and with initiative from the Soviet specialists' advanced knowledge and collaborate with them closely.

Geological organizations and the interested industrial organizations should be closely associated in their work; the same applies to the scientific research organizations, which should collaborate with one another, having one aim - to achieve success in their work in the shortest possible time. In the process of prospecting operations, collaboration should be intensified between the different organizations which will permit the thorough and detailed study of different types of deposits and will present reliable data for complex utilization of useful minerals.

IV. After the liberation of China, thanks to the educational role of the Communist Party, all geologists continuously raised the level of their knowledge both in the political and industrial spheres. In the past, manifestations of bureaucracy, dogmatism, empirism, right-wing deviations and conservatism hindered work. Some workers still retain bourgeois ideology, former methods of working and individualism. In the great move towards regulating the methods of work, such ideological beliefs, such ways of thinking and methods of working were severely criticized. The realization of the general party line has inspired the whole nation, including the geologists, in their struggle for the socialist ideology and the regulating of the methods of work. This resulted in the achievement of great successes in the process of raising political consciousness. Nevertheless, the ideological reform still requires a great deal of time.

The results of geological prospecting, reflected in many reports made at the conference, and the many questions put forward by our comrades during the discussion have shown great achievements accomplished in the past years. The geologists' theoretical knowledge has also increased. Nevertheless, in the past certain comrades treated some important question one-sidedly and uncritically. They did not adhere to the dialectical materialistic principles in their work, which prevented them from discovering the law of the diffusion of useful minerals. In the future such mistakes must be corrected.

During this conference we have had a wide exchange of experiences, we have discussed practical and theoretical problems. This will undoubtedly enable geological practice and science to take a big step forward. We should extend all effort toward achieving the world level in the field of geology and even greater effect from prospecting. For these reasons, geologists must presistently study politics and raise their qualifications. They should endeavour to be fervent party members and highly qualified geologists.

Certain reports dealing with specific subjects and the exchange of knowledge should be thoroughly studied. The facts obtained should be tried out in practice and brought to the attention of the masses.

It is essential to put into practice even further the policy of engaging the whole party and the whole nation in geology. The great and glorious task facing our party and government of "finding still more kinds of raw material resources and in greater quantity" should be achieved promptly.

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SCHEMATIC TABLE OF METALLOGENIC EPOCHS AND DEPOSITS IN CHINA ASSOCIATED WITH THEM

ENDOGENOUS AND METAMORPHIC DEPOSITS	TECTONIC MOVEMENTS	GROUP	SYSTEM	EXOGENOUS DEPOSITS
COPPER, COBALT, GOLD ORE	HIMALAYA	CENOZOIC	QUATERNARY	IRON ORE (YUN'-FU TYPE), PEAT, POTASH SALTS, BORON SALTS, HALITE.
				COPPER (COPPER DEPOSITS OF THE RED STRATUM), COAL, DIATOMITES, ROCK SALTS, GYPSUM
TIN, TUNGSTEN, MOLYBDENUM, COPPER, IRON ORE, LEAD, ZINC, NICKEL, CHROMITE, ANTIMONY, MERCURY, ARSENIC, FLUORITE, ALUNITE, BORON, ASBESTOS, GOLD ORE	YEN'SHAN' INDOSINAITIC	MESOZOIC	CRETACEOUS	COPPER (COPPER DEPOSITS OF THE RED STRATUM)
			JURASSIC	IRON ORE (CHAUN - TSZYAN' TYPE)
			TRIASSIC	COPPER, GYPSUM, MANGANESE (BAYSYAN TYPE), ROCK SALT
COPPER, LEAD, ZINC, CHROMITE, NICKEL, ASBESTOS, IRON ORE AND BAUXITE	VARISSK	PALEOZOIC	PERMIAN	IRON ORE (PEI-LYAN' TYPE), MANGANESE (ZUNI TYPE), PHOSPHORITES (LUNSHAN' TYPE), COPPER (MA-DAOTSY TYPE), FUEL SHALES, COAL, BAUXITE
			CARBONIFEROUS	BAUXITE, IRON ORE (SHAN'SI AND KHEZIN TYPES) MANGANESE (ISHAN TYPE)
IRON ORE AND PHOSPHORITES	CALEDONIAN		DEVONIAN	IRON ORE (NANSYAN TYPE), MANGANESE (GUYPIN TYPE)
			SILUVIAN	PHOSPHORITE (GOATSZY-BYAN' TYPE), IRON ORE (TSZYAN-YU TYPE)
			ORDOVICIAN	IRON ORE (NINNAN TYPE), PHOSPHORITE (MUFUSHAN' TYPE) GYPSUM
			CAMBRIAN	IRON ORE (TSIN - CHZHEN TYPE), PHOSPHORITE (KUNYUN TYPE)
COPPER, GOLD ORE, LEAD, ZINC, IRON ORE, PHOSPHATES, MAGNESIUM; TALC, RARE EARTH ELEMENTS, MICA.	LYUYLYANSK	PROTEROZOIC ARCHEOZOIC	SINIATIC YUNTOSK VUTAYSK	IRON ORE (SYANG-YU AND SYKHAY TYPES), MANGANESE (YANTAN' AND UAFINTSZ TYPES), PHOSPHATES (KAYYAN TYPE), LEAD, ZINC, COPPER (SHIMYN TYPE)

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